MASS Transfer

News from Chemical and Biomolecular Engineering at Illinois

Summer 2014

MASS Transfer

Department of Chemical and Biomolecular Engineering

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Cover image: Fluorescence image of a sheet of cells from the lining of capillaries in lung tissue. The red indicates the cytoskeleton (actin) and green stain reveals the proteins that form the cohesive junctions between the cells. The image was acquired by Adrienne Barry, an MD/PhD student working with Professor Deborah Leckband.

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From the Department Head's Desk

Dear Alumni and Friends,

In May, we completed the academic year of 2013-2014 with our commencement ceremony with Paul Adriani (BS '85, Integration Technical Manager at SunPower) providing remarks to our graduates. This year, a record 130 students received their bachelor's degree and a record 26 received their PhDs. Our graduates continue to be in high demand, with many securing jobs or admission to graduate programs upon graduation.

We had a very successful faculty recruiting season this spring: Four assistant professors will join us next year, which will increase our number of faculty from 13 to 17: **Charles Sing**, who we recruited last year to pursue a computational research program on polymer dynamics, and **Damien Guironnet**, who will join us from BASF to pursue an experimental program on polymers, will start in August. In January **Ying Diao** and **Diwakar Shukla** will join us from Stanford to pursue a research program in molecular assembly and in modeling and simulation of proteins, respectively. You will find more information on these new hires in future newsletters.

As usual you will be able to read about the latest awards and achievements of our undergraduates, graduate students, and faculty. Many of our undergraduates are student leaders for campus organizations; read about their experiences in this newsletter as well as the recipients of scholarships and awards this spring. Our graduate students continue to excel with two named as Mavis Faculty Fellows. And, a graduate student is giving back by being involved with the local robotics program.

Faculty members Charles Schroeder and Mary Kraft received tenure and will be promoted to Associate Professor by the start of the fall semester. Bill Hammack, featured in the previous newsletter, has been named the Donald and Dolores Morris Faculty Scholar, established with a gift from one of our alumni. Assistant Professor Brendan Harley won the Young Investigator Award from the Society of Biomaterials, as well as the prestigious Everitt Award for his teaching from the College of Engineering. Also, after many years of work, Professor Emeritus Tom Hanratty published a book entitled "Physics of Gas-Liquid Flows," which is intended for "engineers seeking to enhance the safety and efficiency of natural gas pipelines, water-cooled nuclear reactors, absorbers, distillation columns, gas lift pumps, and multiphase chemical reactors."

In this newsletter we also acknowledge our donors. It is through the generosity of our alumni, friends, and corporate partners that we are able to continue to provide an excellent education to our students, to hire new faculty, and to upgrade our research labs as well as our undergraduate computer labs and meeting rooms. In recent months two of our PhD alumni received awards from the American Chemical Society: Bill Banholzer (PhD '83, Masel), former CTO of Dow Chemical, received the Barnes Award for Leadership in Chemical Research Management, and Joan Brennecke (PhD '89, Eckert), currently the Keating-Crawford Professor at Notre Dame, received the Murphree Award in Industrial and Engineering Chemistry.

In this issue we hope you will enjoy reading about Professor Deborah Leckband's efforts in investigating how cells send and gather information using mechanical signals, or force, and how these forces play an important role in medical issues such as ventilator-induced lung disease.

Looking ahead to the fall, we would like to invite you to our **homecoming tailgate** on **October 25**, with free food, football tickets, and more. Also, on **October 3-5** we will celebrate the **25-year reunion** of our PhDs from 1987-1991. Connect with the department on Facebook to stay up-to-date on these and other events! I encourage you to share with us your feedback and/or your memories, photos, updates, and more so we can feature these on our website, on Facebook, and in future newsletters. I wish you all a great summer and hope to see many of you back here on campus or on the road.

Best Regards,

Paul J. A. Kenis
William H. and Janet G. Lycan Professor and Department Head
kenis@illinois.edu (217) 244-9214

Professor Hanratty authors new book, "Physics of Gas-Liquid Flows"

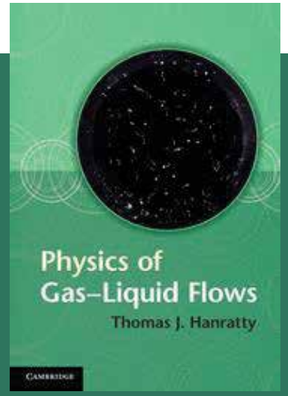
A book by Thomas J. Hanratty on "Physics of Gas-Liquid Flows" was published by Cambridge University Press in October 2013. The text is ideal for engineers seeking to enhance the safety and efficiency of natural gas pipelines, water-cooled nuclear reactors, absorbers, distillation columns, gas lift pumps, and multiphase chemical reactors.

"The review of advanced concepts in fluid mechanics in this book enables both graduate students and practicing engineers to tackle the scientific literature and engage in advanced research," Hanratty said. He observes that "the scientific community recognizes that the principal problem in developing an understanding of the behavior of multiphase flows is to relate macroscopic behavior to small scale interactions. The book summarizes progress in this direction and contributes to the establishment of multiphase flow as a new branch of fluid dynamics."

Hanratty is professor emeritus in the Department of Chemical and Biomolecular Engineering at the University of Illinois. He joined the faculty of the Chemical Engineering Department in 1953, retiring in 2007. After retiring, he spent one year as Acting Head of the School of Chemical Sciences and presided over a reorganization of the School. He has continued his research activities through interactions with postdoctoral students and visiting scientists.

Hanratty's research has received numerous recognitions including the inaugural Multiphase Flow International Prize, honorary doctorates from Institut National Polytechnique Toulouse and Villanova University. He has been elected to the National Academy of Engineering, the National Academy of Sciences, and the American Academy of Arts and Sciences.

"Physics of Gas-Liquid Flows" leans heavily on contributions from the Hanratty laboratories. "The eye catching jacket was produced by James B. Young," Hanratty said. "It captures trajectories of particles in a turbulent liquid flowing down a vertical pipe." Cross-sections at several locations were illuminated by thin light sheets having different colors. Axial viewing photography was used to capture the paths of the particles; the color of a particle gives its axial location.



CAMBRIDGE UNIVERSITY PRESS PROVIDES THE FOLLOWING REVIEWS OF HANRATTY'S BOOK:

"This authoritative and impressive monograph, written by a widely acclaimed pioneer in this field, is an excellent resource for new students as well as seasoned practitioners. It develops concepts systematically and packages many decades of literature in this field lucidly, giving readers a chance to understand and appreciate the evolution of this field."

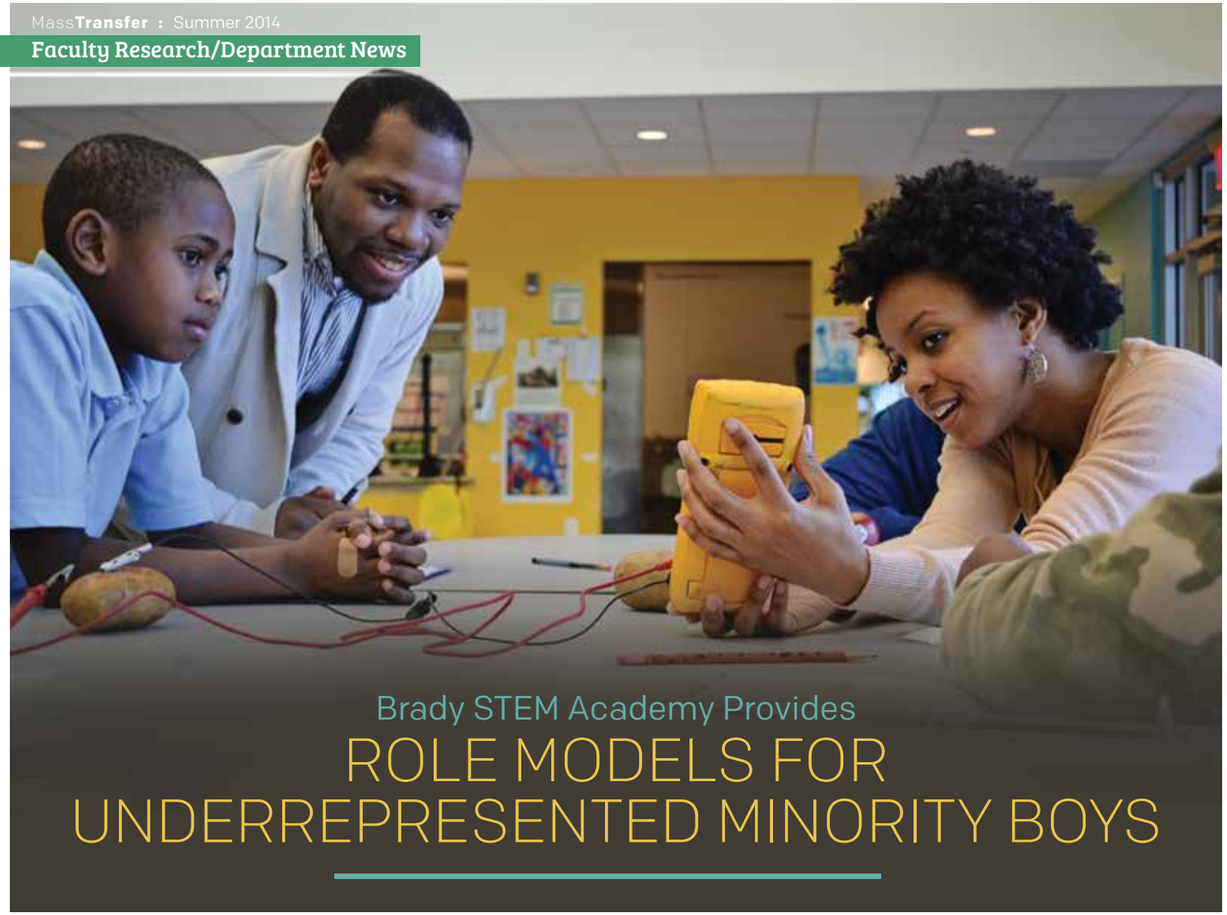
-Sankaran Sundaresan, Princeton University

"Physics of Gas-Liquid Flows" is a must read for graduate students, researchers, and engineers seeking a solid basis or wanting to update their knowledge in the dynamics of gas-liquid systems. The book is an authoritative reference, mainly built around the results of the author, a leading expert in the field during several decades. It presents our current experimental and theoretical understanding at both the local and global scales with an original contribution to wave phenomena as they appear in film, stratified, and annular flows that may be a source of inspiration for researchers and teachers in the years to come."

-Jean Fabre, Institut National Polytechnique, Toulouse

"A lifetime of probing research and deep thinking about gas-liquid flows is enclosed between the covers of this book. Starting from simple analyses—the style of which will be familiar to many undergraduates—the author moves gradually to more advanced topics building a succinct yet exhaustive picture of the present understanding of these important flows. Practicing engineers and researchers alike will find many gems in this book.

-Andrea Prosperetti, Johns Hopkins University



Brady STEM Academy Provides
ROLE MODELS FOR UNDERREPRESENTED MINORITY BOYS

Some outreach-minded folks in chemical engineering have begun a new after-school program, the St. Elmo Brady STEM Academy, hoping to make a difference in the lives of underrepresented minority boys. While programs providing hands-on STEM activities happen fairly frequently at Booker T. Washington STEM Academy (BTW) in Champaign, Illinois, what sets this program apart is its emphasis on minority role models— including the boys' own fathers.

This unique aspect—the idea of involving fathers—came from a program Dr. Jerrod Henderson, a lecturer in the department, and Ricky Greer, a specialist in K–12 education, recently created then piloted at the Don Moyer's Girls' and Boys' Club in Champaign.

Regarding the fathers' involvement: "It had a great impact on the kids and their excitement," recalls Greer, "and we really enjoyed seeing the fathers get down on their hands and knees and work on the projects with their sons."

The St. Elmo Brady STEM Academy will run for eight weeks with three sessions a week—one intentionally held on Saturday so the boys' fathers can attend.

However, while involving fathers is an important aspect, for some young participants, the father might not be in the picture; the second program component involves recruiting Illinois graduate and undergraduate students to mentor the young participants.

The third member, Allante Whitmore, a Ph.D. student in Agricultural & Biological Engineering, indicates that student mentors will also serve as role models to demonstrate that, "Hey, I'm going to college. You can do it too."

The program will incorporate role models during the activities. While addressing a different topic each week, Henderson, Greer, and Whitmore will showcase a multicultural scientist who has contributed to that area, such as the program's namesake, St. Elmo Brady. This emphasis on African-American scientists who paved the way was added because of the positive role models they can be for students of color.

To ensure the program's success, the program is targeting 4th and 5th grade underrepresented males who are interested in STEM, hoping to get them interested in STEM early.

While the three hope to lure some young men into the STEM pipeline, they admit that one reason they're doing the program is they just plain love teaching.

Henderson admits that he's always wanted to teach: "From early on, I knew that I wanted to be a teacher. I had mentors in my life that pushed me towards, 'Well, if you want to teach, this is what you're going to have to do. It was always those mentors that had an outreach component to what they were doing.'"

Like the mentors who helped him, Henderson wants to lend a hand to some youngsters in this community:

"In my community, in the colleges where I attended, that's the culture. You give back to your community, and I was raised with that. You don't think twice about it. That's what you're supposed to do; you reach back and you help others."

The team's personal goals for the program are varied. Greer wants to reach out to young African-American males: "You just have to work, be that mentor, and show them that it is possible to be successful...And again just having a passion for the community and wanting to uplift the community."

"I want to expose these young people to STEM," says Henderson. "But beyond STEM... whatever career path they choose, I feel that they are going to look back and say, 'I remember when I was in this program, and these people really helped to push and encourage me.' And it'll go a long way. I'm just a proponent of exposure."

Henderson goes on to share how some of the things he was exposed to as a youngster influenced his becoming a chemical engineer:

"I always liked science, for some reason," he confesses. Maybe it's because as early as 6th or 7th grade, he was going to engineering conferences. Leaders of his community's mentoring program said, 'We're going to give these kids something to do!' They took him and other kids to college open houses and football games.

Henderson envisions a scenario in which his mentoring program might have that same kind of influence in these youngsters' lives: "While we might expose them to STEM, they might also get the chance to travel to these conferences that we have talked about. And all of it came about because they were part of a STEM program."

To support Outreach Programs such as the Brady STEM Academy, contact Lauren E.B. Dodge at (217) 333-7108 or Matthew Campion at (217) 244-1103.

Story and photographs by Elizabeth Innes, Communications Specialist, I-STEM Education Initiative.

Left to right: A student, Dr. Jerrod Henderson, and Lonna Edwards measure the voltage of a "potato battery" the student made during the Brady STEM Academy after-school program.

Dr. Jerrod Henderson helps a youngster with his potato battery during one of the program's sessions.

Ricky Greer demonstrates an experiment they might perform for Brady STEM Academy participants.

We Welcome New Faculty to the Department!

Four assistant professors will join the Department in the next year which will increase the number of faculty from 13 to 17.

Damien Guironnet and **Charles Sing** will start in August 2014. Sing will pursue a computational research program on polymer dynamics. Most recently, Sing was an International Institute for Nanotechnology Postdoctoral Fellow at Northwestern University. Guironnet will pursue an experimental program on polymers, seeking to design new catalysts and catalytic processes to transform bio-based and oil-based feedstocks into chemicals. He has most recently served as a Research Scientist at BASF Corporation.

In January 2015, **Ying Diao** and **Diwakar Shukla** will join the Department from Stanford University. Diao's research program focuses on molecular assembly and to achieve sustainable manufacturing of high performance therapeutic products and energy devices. She has served as a Postdoctoral Scholar at Stanford University. Shukla will pursue a research program in modeling and simulation of proteins with areas of interest in understanding behavior of key cellular signaling proteins involved in cancer for drug design and development.

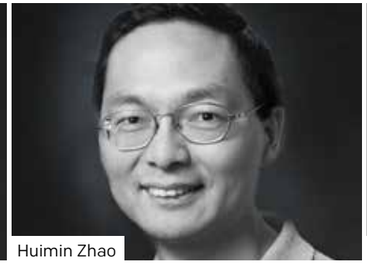
Top left, Damien Guironnet; top right, Charles Sing; bottom left, Ying Diao; bottom right, Diwakar Shukla


Christopher Rao


Brendan Harley


William Hammack


Charles Schroeder


Huimin Zhao


Jonathan Higdon

Associate Professor Christopher Rao accepted the **Excellence in Research Award** from the College of Engineering for his research accomplishments in the area of biomolecular engineering, on topics such as infectious disease, bioenergy production, and synthetic biology.

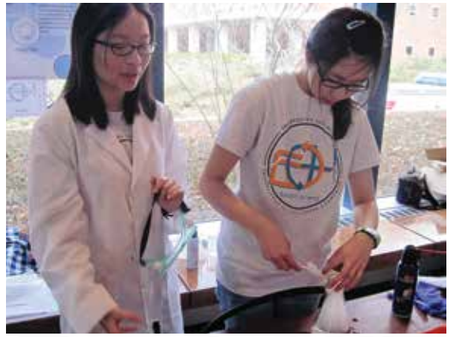
Assistant Professor Brendan Harley is the recipient of the **2014 Young Investigator Award** of the Society of Biomaterials. This award recognizes Harley's outstanding achievements in the field of biomaterials research including his pioneering approaches to create biomaterials that replicate the form and function of inhomogeneous structures in the body. "This award is very much a reflection of the excellent trainees I've had at Illinois whose hard work helped make this possible," he said. He also was honored with the **Everitt Award for Teaching Excellence** for development of an innovative elective course on tissue engineering. The winner of this award is selected by students from the Engineering Council from the College of Engineering.

Professor William Hammack was named the **Donald and Dolores Morris Faculty Scholar**. This Faculty Scholar position has been established through a gift from alumnus, Mr. James M. Morris of Houston, Texas, to commemorate his parents. Hammack has pioneered new areas of communicating science and engineering to the general public, and he has expanded the role of an engineering professor. He developed a unique radio series that shares the 'hows and whys' of engineering to the public, which was broadcast around the world. More recently, he has pioneered the use of new media, specifically videos accompanied by books, to communicate engineering marvels to the next generation of engineers.

Assistant Professor Charles Schroeder has been named a **Beckman Fellow in the Center for Advanced Study** for 2014-15 at the University of Illinois. Schroeder was selected for his research proposal, "Molecular Design and Engineering of Materials for Advanced Functionality." Schroeder and his team of researchers are working to develop new methods for synthesizing sequence-defined polymers and for studying polymer dynamics using single molecule imaging. The Center for Advanced Study professors are permanent members of the center, appointed after a rigorous nomination and election process; these appointments are among the highest forms of campus recognition.

Centennial Chair Professor Huimin Zhao is the recipient of the **2014 Gaden Award**. The Gaden Award is named in honor of Elmer L. Gaden Jr., the founding editor of Biotechnology & Bioengineering, and is given in recognition of an outstanding paper published in the journal in the past year. Huimin and his colleagues are recognized for the paper: Cloning and characterization of a panel of constitutive promoters for applications in pathway engineering in Saccharomyces cerevisiae, authored by Jie Sun, Zengyi Shao, Hua Zhao, Nikhil Nair, Fei Wen, Jian-He Xu, and Zhao.

Professor Jonathan Higdon has been named the inaugural **Dennis and Cathy Houston Professor in Chemical and Biomolecular Engineering** at the University of Illinois, effective August 16, 2013. This professorship recognizes Higdon's research in developing new techniques in computational science and applied mathematics with application to high impact engineering applications. The Professorship was made possible by Dennis and Cathy Houston. Dennis Houston received a bachelor of science degree in Chemical Engineering from the University of Illinois in 1974. After graduation he joined Exxon, eventually reaching the position of executive vice president of the ExxonMobil Refining and Supply Company. After his retirement from ExxonMobil in 2010, he has held the position of director for various companies, including Argus Media, PBF Energy, and GasLog. The investiture will take place October 6, 2014 at the Illini Union on the Illinois campus.



Engineering Open House 2014:
Chemical Engineering student projects recognized

More than 150 Chemical Engineering students participated in this year's University of Illinois 94th annual Engineering Open House. This annual two-day event took place in March and featured 250 exhibits and attracted more than 20,000 visitors to the campus.

Chemical engineering students participated in the open house as team members and volunteers. There were 112 students in groups sponsored by the Illinois chapter of American Institute of Chemical Engineers. The following groups had award winning exhibits this year.

CATEGORY: **Just for Fun—Just Because**
SECOND PLACE: Ice Cream Stand
TEAM MEMBERS: Naif Aldalaan, Valentina Ricupati, Talia Shalen, Ryan Sanders, Morgan Sargeant, Grace Smith

The group showed how ice cream could be turned into homemade dippin' dots using liquid nitrogen.

THIRD PLACE: Crazy Crystals
TEAM MEMBERS: Anooj Avashia, Daniel Defenbaugh, Rachel Lesorgen, Grace Redeker, Danielle De Vera, Manasi Dave

The team demonstrated the process of instant crystallization by adding small amounts of sodium acetate to a supersaturated solution.

CATEGORY: **Best Kickoff of EOH**
SECOND PLACE: PetroWorld
TEAM MEMBERS: Maciej Kowalkowski, Zain Lakhani, Ellery Marks, Shayta Roy, Marc Truc, Neha Shiroor

This group demonstrated the principles of density and fluid pressure by showing drilling through different layers to mimic crude oil.

CATEGORY: **The Real World**
FIRST PLACE: Chemistry Behind Food
TEAM MEMBERS: Chris Kim, Patrick Sayles, Connie Wong, Annmaria Vincent, Rishabh Poddar, Eric Hwang

This exhibit explored how the food industry uses chemistry and controls process conditions to improve food quality and increase shelf life.

CATEGORY: **Most Innovative Exhibit**
THIRD PLACE: Atmospheric Pressure Plasma Jet
TEAM MEMBERS: Nick Connolly, Allie Rogers, Casey Fee, Adam Connor, Xinyu He, Scott Kieback

The team showcased an atmospheric pressure plasma jet and explained the many processing applications with it.

2014 Undergraduate Scholarships and Award Recipients

Each spring, scholarship awards are given to students in each class level from donations given to the department. Awards are distributed according to the wishes of donors. This year, more than $96,000 was awarded to undergraduate students during the annual awards ceremony in April.

American Institute of Chemical Engineers Service Award
Kevika Rustagi (Fall '13), Sophia A. Friedman (Spring '14)

Franklin A. Boyle Award
Maciej K. Kowalkowski

Chemical Engineering Alumni Award
Claire N. Gibbons

CITGO Award
Mark A. Taylor

DuPont Science & Engineering Award
Hector A. Fuster, Amanda M. Pritchard, Benjamin D. Kanevsky

Robert S. Frye Award
Grant V. Blazina

Clarence G. Gerhold Memorial Award
Anthony J. Tapia

Dr. Joseph and Donna Glas in Memory of Professor James Westwater Award
Alex Baciu

Chester W. Hannum Scholarship
Aristotle E. Economou, Brandon M. Sprenger, Ross M. Romane

Edmund D. and Sara J. Heerdt Scholarship
Kevin B. Weyant

Earp Jennings Award
Rachel M. Beck

Kimberly-Clark Corporate Award
Aaliya Mumtaz

John W. Latchum, Jr. Scholarship
Yuliana Mendez

R. J. Van Mynen Award
Shayta Roy, Eugene F. Swisher

Omega Chi Epsilon Award
Sarah A. Kuhl

Edward I. Onstott Chemical Engineering Award
Grace R. Diekemper

Worth-Huff Rodebush Award
Kevin Erning

Rohm & Haas Chemical Engineering Award
Brett M. Llewelyn

Thomas R. and Yolanda S. Stein Award
Jake A. Bennett, Daniel C. Spence

Glenn E. and Barbara R. Ullyot Award
Alexander G. Olenskyj, Pawel Grimm, Erica L. Peterson, Xiaoxuan 'Lily' Chen

Bruno H. Wojcik Scholarship
Xinyu He

In addition to the scholarships awarded in April, the Undergraduate Research Symposium took place which showcases undergraduate research initiatives. This year's poster presentation winners were chemical engineering students: Lily Chen, Jacob Hanselman, and Sarah Laken.

Bakies honored as Knights of St. Patrick

Morgan Bakies, a chemical engineering undergraduate, has been named a Knights of St. Patrick recipient for 2014. She was one of 10 engineering students selected to receive this honor that has been awarded since 1950.

Leadership, excellence in character, and exceptional contribution to the College of Engineering and its students are the attributes necessary for selection to the Knights of St. Patrick, one of the highest honors given by the College.

Honorary Knights are nominated individuals who have demonstrated leadership in his or her field, contributed to the enhancement of student activities, and demonstrated excellence in character.

CHEMICAL ENGINEERING CONDUCTS UNDERGRADUATE CONVOCATION

More than 100 undergraduate students from the Chemical and Biomolecular Engineering Department at the University of Illinois graduated on May 18.

Dr. Paul Adriani was the convocation speaker for the event which took place at the Krannert Center for the Performing Arts at the Urbana-Champaign campus. Adriani earned his bachelor's degree from the University of Illinois in 1985 and then completed his master's and doctorate degrees at Stanford University.

Adriani is the Integration Technical Manager at SunPower Corporation. He has more than 20 years of technical and senior management experience with Fortune 500 and start-up companies. His most recent experience is in developing new products that convert sunlight into electricity as a small part of the worldwide effort to scale up renewable energy, reduce carbon emissions, and reduce climate change.

He welcomed the students and applauded them for graduating from one of the best chemical engineering departments in the country.

"Find your own path that fits your values," he encouraged the graduates. "You have the security of having your own purpose and securing your dream."

Adriani left the students with some tips as they transition to their next steps in life.

- You have a long time ahead of you. Do course corrections along the way.
- Be sure to expect failures.
- Keep pursuing your passions and interests.
- Work hard.
- Be excellent in what you do.
- When you are listening to others you are learning. And, when you are talking you are helping other people learn.

Brian Ross, Interim Dean at the College of Liberal Arts and Sciences, congratulated the graduates on their achievements. "Graduates you have grown greatly. You are graduating from an excellent department and an excellent university."

Dr. Paul J. A. Kenis, William H. and Janet G. Lycan Professor and Department Head, presented the graduates to a standing ovation from family and friends during the ceremony. Kenis wished the students the best in their futures. "Stay in touch with us. Let us know how you are doing. And, we welcome you back for Homecoming on October 25 as alumni to our tailgate tent."

The department also had 11 students graduate with a Master of Science Degree in chemical engineering and 26 students graduate with a Doctor of Philosophy Degree in Chemical Engineering.

"Science searches for a solution to a problem, but engineering creates one. The ability to design something to solve problems and improve lives attracted me to chemical engineering."

Supriya Hobbs
Society of Women Engineers President

Chemical Engineering students:
LEADERS IN CAMPUS ORGANIZATIONS

While taking classes is one way to meet new people and stay involved during college, some students choose to become members of student organizations, often taking leadership roles in those groups.

Students in Chemical and Biomolecular Engineering at the University of Illinois are leaders in various engineering registered student organizations on campus.

For senior Eugene Swisher, joining Omega Chi Epsilon (OXE) during his sophomore year was a great choice and way to branch out into other organizations. OXE is the national honor society for chemical engineering and promotes high scholarship (members need a 3.3 GPA), integrity, and leadership.

Swisher is president of the 30 member group that hosts events throughout the year. "Many of us have had internship experience and good connections in industry," Swisher said. "This allows us to come up with unique opportunities for our members."

He says he came to Illinois because the chemical engineering program is highly ranked, and the University is close to his hometown of Columbia, Missouri. He graduated in May 2014 and will work at PepsiCo in Valhalla, New York as a research and development engineer.

Dr. Jerrod Henderson, a lecturer at Chemical and Biomolecular Engineering at Illinois, says having students serve on these organizations is beneficial to their educational career. "Student organizations help make our students well-rounded and provide them with opportunities to develop as young professionals outside of the classroom," he said.

Society of Women Engineers (SWE) President Supriya Hobbs said she was led to chemical engineering because of the design aspect of the field. "Science searches for a solution to a problem, but engineering creates one," she said. "The ability to design something to solve problems and improve lives attracted me to chemical engineering."

The Society of Women Engineers is a technical, professional, social, and outreach organization at Illinois, with more than 14,000 members nationwide. Hobbs joined the society as a freshman where she led engineering activities for kindergartners at Leal School in Urbana. "The variety of events that SWE hosts meant that I could be involved for several years and not get bored," she said.

Highlights of the group include attending the society's annual conference that brings together more than 6,000 female engineers; this year 52 Illinois students attended the event. The Illinois chapter of SWE won nine national and two regional awards at this year's conference. Each spring the group hosts Night of Networking where students can network with companies while attending dinner and workshops.

Pictured above: Illinois AIChE members take a break on the quad.

Society of Women Engineers help clean up Green Street on campus; the group adopted part of that street.

Upon graduating in May from Illinois, Hobbs will be a Process Engineer at Eli Lilly & Co. in Indianapolis.

Senior Takeya Green and president of The National Society of Black Engineers (NSBE) says she joined the organization because she wanted a group to help her through the early academic struggles. The group helps to increase the number of black engineers who excel academically, succeed professionally, and positively impact the community.

"NSBE is my second family," she said. "We all are always with each other, we do a lot of social events with each other, and even after graduation, everyone still stays in contact with each other." Green, who graduated in May, will move to Houston, Texas to be a process engineer at The Dow Chemical Company.

Members of Society of Women Engineers accept an award from the Society's president.

Joining the American Institute of Chemical Engineers (AIChE) led to senior Erica Peterson meeting some of her best friends at the group's ice cream social during her freshman year. AIChE is the world's leading chemical engineering professional organization; undergraduate students join AIChE for free to network and learn about the organization.

For the 2012-13 academic year, the student chapter earned an outstanding chapter award for the third consecutive year. The award was presented at the national AIChE conference and given to 16 of the approximately 200 active student chapters in the United States.

As AIChE president, Peterson said she enjoys spending time studying and visiting in the AIChE office and how AIChE hosts corporate events from meetings to tailgates to mock interviews and coffee chats. "It gives our members a great opportunity to learn about the company and the chance to meet some of the recruiters." Peterson joined General Mills, Inc. in their Metheun, Massachusetts plant outside of Boston following graduation in May.

Department Lecturer Dr. Troy Vogel says that chemical engineering at Illinois includes "students who are some of the brightest in the nation." "Teamwork and working with others is an important characteristic that employers look for when hiring," Vogel said. "Many of our student leaders have jobs secured half way through their senior year, six months before graduation."

Students in the chemical engineering program are leaders in other registered student organizations including Adam Dornford, vice president of Illinois Biodiesel Initiative and president of OSTEM (Out in Science and Technology, Engineering, and Mathematics); Ayesha Mumtaz, external vice president of the Society of Hispanic Professional Engineers, Juan Ralph Alhambra III, president of the Society of Asian Scientists and Engineers; and Hector Fuster, president, National Organization for the Professional Advancement of Black Chemists and Chemical Engineers.

SHARING ROBOTICS AND ENGINEERING:

Giving back to local youth

Teaching kids about engineering through real-life examples is one way that Brent Denton gives back to the Champaign County community.

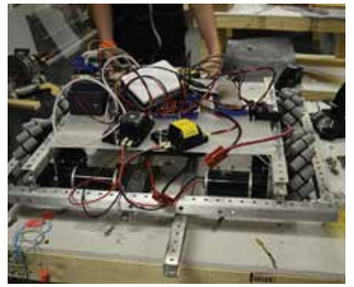
For Denton, that means sharing his love of engineering and robotics with local youth through the FIRST (For Inspiration and Recognition of Science and Technology) Robotics program.

The Chemical and Biomolecular Engineering graduate student, who is a member of Assistant Professor Mary Kraft's research group, says he became involved with FIRST Robotics as a member in 2004. "I knew how much I gained from it," he says. "I couldn't help but give back to the program here at Illinois."

Denton came to Illinois after graduating from the University of Wisconsin at Madison with bachelor's degrees in chemical engineering, chemistry, and applied mathematics and a minor in biology in engineering. He says he chose Illinois because of the large number of bio-chemical engineering opportunities. His current research focuses on characterizing and understanding cell membrane organization.

He says his involvement with the team and his science, chemistry, and engineering classes led to an interest in chemical engineering while in high school. "In my high school robotics team, I worked largely in computer aided design and eventually became the design team leader my senior year," he said.

FIRST Robotics began in 1989 and was founded to inspire young people's interest and participation in science and technology with teams open to youth ages six to 18. Locally, Denton is a mentor for a FIRST Robotics Competition team #4096, known as Ctrl-Z, that includes 25 high schoolers who meet year-round. The team is open to eighth through 12th graders who are challenged to raise funds, design a team brand, develop



teamwork skills, and program a robot to perform prescribed tasks against a field of competitors.

"The focus of the program is to spread a passion for STEM (science, technology, engineering, and mathematics) throughout the community – with the highest awards focusing on that and not on the robots," Denton said.

working with the Ctrl-Z students is extremely rewarding. "It's such an easy and enjoyable way to help teach kids. I enjoy being able to be a part of the team as it grows to be a larger part of the community."

Denton is involved in the technical projects on the team including helping the students build an adjustable drive-train. He also is working with the group to implement a mechanism to vary the angle of the robot's Frisbee shooter.

Each January a new challenge is unveiled where teams have six weeks to build a robot that weighs about 150 pounds; kits are provided by FIRST. "Ctrl-Z is a relatively new team, just beginning its third year of existence, but has been selected to compete in the elimination rounds of every competition they've attended," Denton says.

In the off season, the team has weekly events and demonstrations and fundraises for the upcoming year. "There's a great integration between professional, parental, and collegiate mentors on the team, and everyone is welcomed to join if they want to help."

The team is comprised of 4-H members but is open to the community as part of a 4-H Special Interest (SPIN) Club. Team members come from Champaign, Urbana, and Mahomet schools, but is open to all students in Champaign County, who must become 4-H members to join the team.

"The students get involved because it's just plain fun," Denton says. "They all find parts of the team they really enjoy from programming robots and websites to physically building a robot to designing all sorts of elaborate systems."

To learn more about the Ctrl-Z (#4096) robotics team visit team4096.org.

Two graduate students named Mavis Future Faculty Fellows

Danielle Mai

Kai-Wen Hsiao

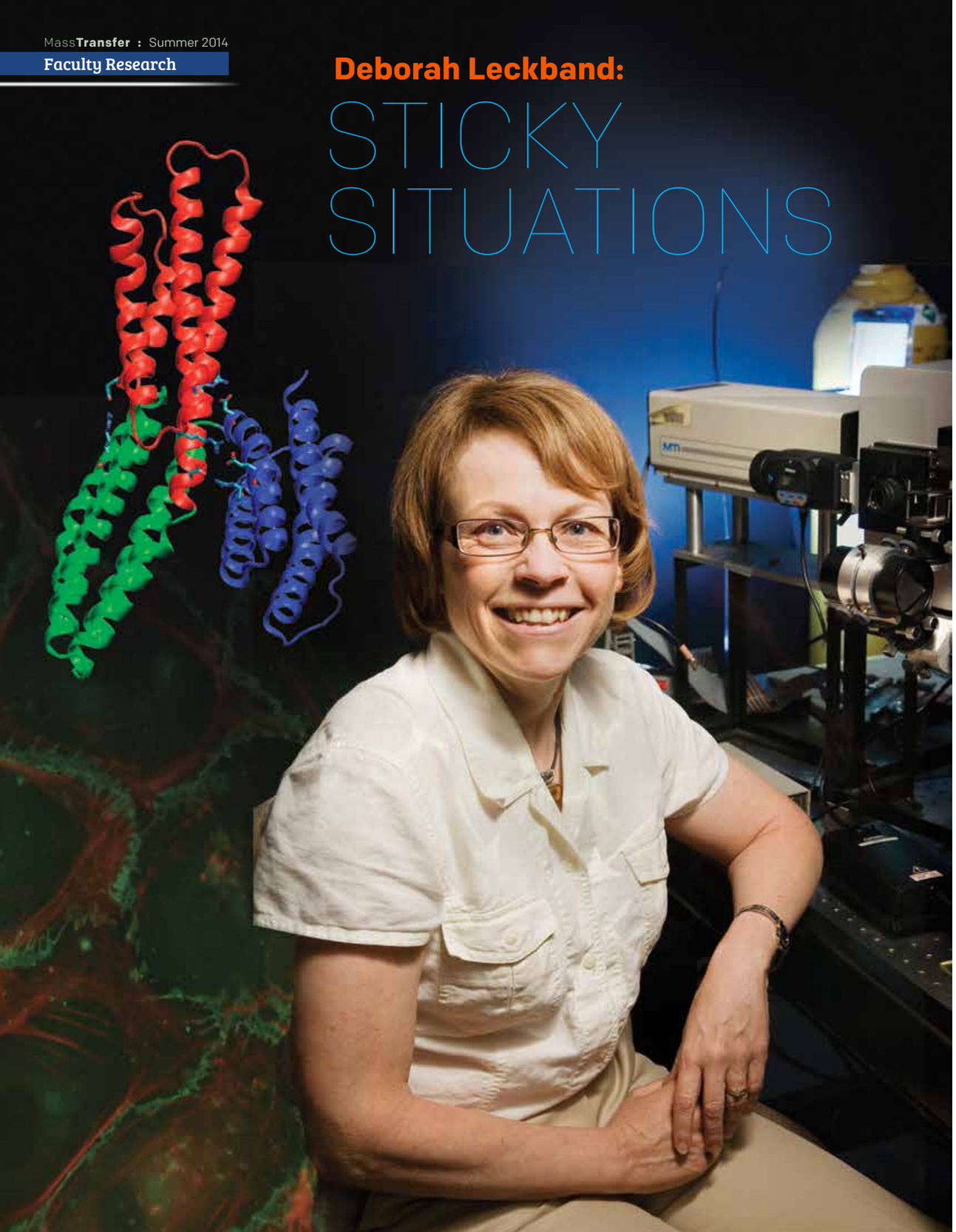
Danielle Mai and Kai-Wen Hsiao, both graduate students in Assistant Professor Charles Schroeder's research group, each have been named Mavis Future Faculty Fellows.

The Mavis Future Faculty Fellow program in the College of Engineering is to facilitate the training of the next generation of engineering professors. The Fellows program focuses on research, teaching, and mentoring and provides resources to students who want their next step to be into the field of academia.

This is the second year that Mai has received the award; the first year for Hsiao.

The Fellows program is made possible by a gift from Frederic T. and Edith F. Mavis. Dr. Mavis received his bachelor's, master's and doctorate degrees in civil engineering from the University of Illinois.

Deborah Leckband: STICKY SITUATIONS



Where, when, why and how do molecules say to one another, "Hey, let's stick together?"
That's the fundamental question that Deborah Leckband, Milner T. Reid Professor of Chemical Sciences, ponders.

Leckband first became interested in adhesion on surfaces where it causes problems: ships' bottoms fouled with algae, contact lenses coated in protein deposits, implanted devices coated in molecules that trigger an immune response. What is the chemical basis of adhesion and how can we control it, Leckband wanted to know.

But pretty quickly Leckband realized that the field of cell surface adhesion is broadly fundamental and affects many different aspects of biology. For example, she has investigated issues in wound healing, drug delivery, and pathogen recognition. Because of the wide-ranging applicability of her field, she has appointments in many places beyond her home of Chemical and Biomolecular Engineering, including biochemistry, nanotechnology, and the Beckman Institute. She is also director of the campus-wide graduate bioengineering program.

Leckband started out to understand the chemical basis of non-specific adhesion and how to manipulate it. She helped develop polymer coatings on implants and on drug carriers, to improve their effectiveness.

From there Leckband became interested in situations where adhesion is desirable. How do proteins intentionally promote or prevent natural biological adhesion? In the case of implants, for example, are there material properties that might promote adhesion and thus encourage tissue to grow around an implanted scaffold?

"This gets us into the biological aspects of our work in that we are looking at how adhesive contacts between cell surface receptors and these materials influence how cells respond to those materials through biophysical signaling pathways," says Leckband.

This work led Leckband to investigate how cells send and gather information using mechanical signals, or force.

"For years researchers have focused on how soluble chemical signals and electrical signals influence cell and tissue functions, but in the last decade or so people started to realize mechanical signals are probably just as important," she says.

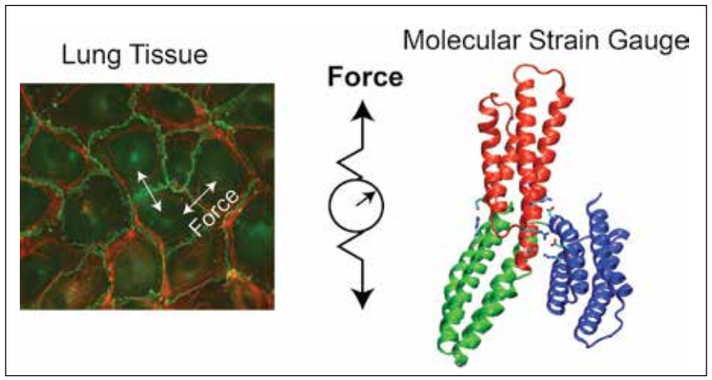


Figure 1. During ventilation, lung inflation increases the force at the junctions between cells. Proteins at these junctions that function as molecular strain gauges (right) undergo changes in response to force that alter biochemical signals in the cell.

Working with Ning Wang, professor of mechanical science and engineering, Leckband's team discovered a group of proteins at the contacts between cells — already known to hold cells together in tissues — that are also force sensors.

"Proteins are not only important in mediating the physical gluing of the cells to the surface, but also are transmitting biochemical and mechanical signals to the cell that tells the cell how to function in that environment," says Leckband, of that finding.

Working with Hyunjoon Kong, also a professor in the department, Leckband is investigating how the discoveries she made with Wang might influence stem cell differentiation, and thus tissue formation, as well as neural networks.

In related work, Leckband is studying ventilator-induced lung disease in collaboration with a pulmonary medicine group in Chicago. This mechanically induced pathology occurs when normal forces exerted on the lung tissue by a ventilator cause fluid to leak into the air spaces in the lungs.

Leckband's group has built devices that enable them to monitor cell behavior when the lung tissue is subjected to mechanical perturbation. They then use quantitative methods to analyze the results. This approach leads to better understanding of the processes involved.

These techniques help Leckband's group understand the basics of lung injury as well as the influence of genetic variation on susceptibility to lung injury. These same tools help them quantify the effects of protective drugs to understand how different drugs may either protect against injury or promote repair after the fact.

In another medical example, Leckband worked with a group in London to understand how the structure of adhesion proteins on dendritic cells within the immune system enable the dendritic cells to recognize, bind to and then destroy pathogens. Sometimes pathogens, such as HIV, take advantage of these proteins to attack and destroy the immune system. Leckband's group identified certain features of the adhesion molecules on the dendritic cells that might be important for their ability to recognize both viral and microbial pathogens.

Although she doesn't explicitly espouse it, Leckband personifies the "Lean In" philosophy that Sheryl Sandberg of Facebook has made a household term. In a field in which women are scarce, Leckband, a woman who measures her words carefully and precisely, makes sure to always take her place at the table, to lean in.

> **"Engineering is more than coming up with a cool discovery. It's also about how to get the product to market."**

"My philosophy has always been that if you act like you belong there, then you will. People will accept you," says Leckband, one of two female faculty members in the department.

Leckband's interest in translational work is also reflected in her teaching. This past fall, for example, she taught an upper-level seminar on techniques in biotechnology. The course demonstrated how biological information is used to generate new technologies but also emphasized meeting design targets and understanding how to make a good product.

She had the students analyze different products, such as a pregnancy test, and explain how the technology was developed to achieve the goals. The students had to identify the design goals. In the case of a pregnancy test those goals would include needing to be fast and easy to use. Students then determined whether and how the product met those goals.

"Engineering is more than coming up with a cool discovery," says Leckband. "It's also about how to get the product to market."

The kinds of problems Leckband's lab works on concern these precise goals.

"We are always asking, 'How can this information be used to make a better product?'"

Article by Deb Aronson

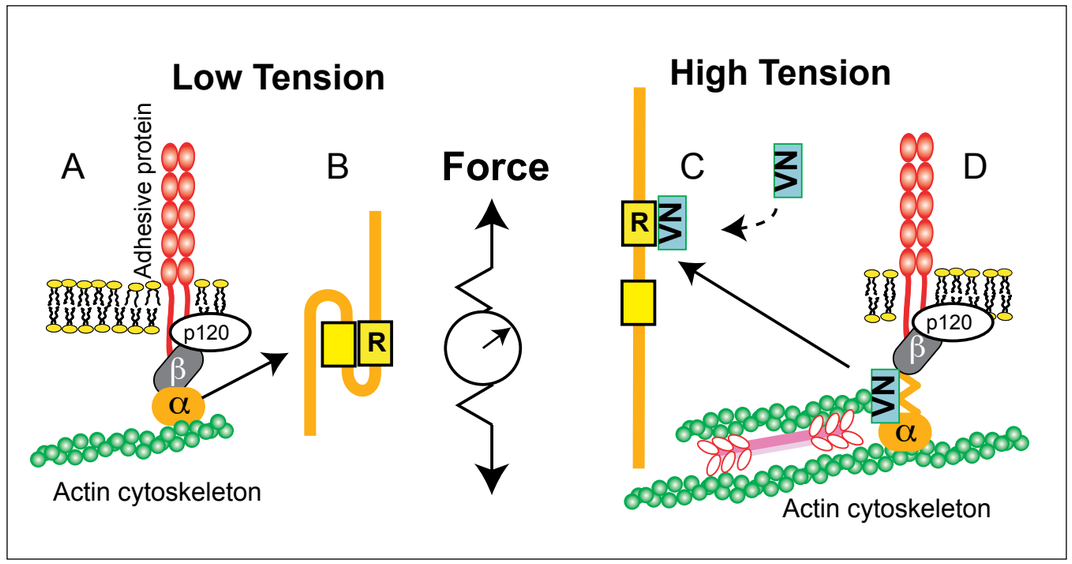


Figure 2. Adhesive proteins (red) at the cell membrane adhere to proteins on adjacent cells, and they also bind proteins inside the cell that couple the adhesive proteins to the actin cytoskeleton (A). (B) One of these proteins (alpha-catenin, orange) is folded up at low tension, to mask a reactive site, R (yellow). (C) At forces high enough to stretch this protein (typically 4-10 picoNewtons), the reactive site is exposed. (D) This exposed reactive site can bind other proteins (VN, blue) that trigger a cascade of reactions in the cell.

Crowdfunding campaign launched for dolls of historical women

Janna Eaves and Supriya Hobbs

University of Illinois students Supriya Hobbs and Janna Eaves came up with the idea for Miss Possible, a business that sells dolls based on actual women who contributed to science, technology, engineering and mathematics.

The dolls envision the historical figures as 10-year-old children and come with downloadable mobile apps that provide background on the women and instructions for hands-on activities.

On July 12, Hobbs and Eaves launched an Indiegogo crowd-funding campaign to raise $75,000 to support their business venture. Hobbs, who graduated from the Chemical and Biomolecular Engineering department at the University of Illinois this spring, provided an update on the company and its plans. Here are some excerpts from that interview:

What will the $75,000 enable you to do?
That would let us place the first order for our dolls — 5,000 Marie Curie dolls. We have to do the manufacture in China; no one in the States is making these (types of) dolls any more.

What levels have been pledged so far?
We've gotten a couple of $500 pledges. The next highest was $250. The $120 pledge is the most popular; for that, you receive the first three dolls (in the series) as they are released.

How would you describe the Marie Curie doll?
It's a 14-inch doll with brown hair and green eyes and wearing a dark purple dress and green lab coat. It's made of vinyl, like most dolls you see on the shelves now.

On the (accompanying) app, we are going to have the story of this woman. Something you don't see others (in the doll industry) doing is giving instructions for hands-on activities. Parents don't necessarily want their kids staring at a computer screen all day. We bring a hands-on component. The first activity is making a compass. You can't have kids working with radiation (as Marie Curie did), so we decided to work with magnetism instead. The app includes instructions (for the activities) and explanations of the science behind it.

We also give instructions for making 'slime.' Using Elmer's glue and borax, you can produce a chemical reaction that makes a polymer that feels similar to Silly Putty. You can change the recipe to make it harder or softer. You can add corn starch to make it into a bouncy ball.

How did you select Bessie Coleman and Ada Lovelace as the follow-up dolls to Marie Curie?
We think it's important to feature a diverse group of women. Part of the premise of Miss Possible is, we want girls to look at these dolls and see themselves, to see role models who look like them — people of different races and ethnicities in different fields.

Bessie Coleman was the first African-American female aviator and the first black woman to get an international pilot's license.

Ada Lovelace was the first computer programmer — not just the first female computer programmer. We thought that was really cool. Even though the numbers are getting better, computer science is a very male-dominated field. We show cool opportunities (for women) in the app. We're teaching girls about code in the app.

Rendering of Marie Curie doll

How much will the dolls cost later on?
Forty dollars is the early-bird price (for Marie Curie) on Indiegogo, which includes shipping. The normal price for the doll is $45, and we anticipate it will cost $45 on the shelves as well. A lot of (whether we sell it in stores) hinges on how well this campaign goes. If we're able to knock it out of the park, we should be able to sell them on shelves in toy stores in coming years. Online is also a very big outlet for sales, and I anticipate we'll get significant sales online.

What have you been hearing from people since the Indiegogo campaign started?
Several have been saying, 'I want one of these and I don't have any kids.' One mom said her daughter saw Ada Lovelace on the campaign page and now thinks it might be neat to be a computer programmer.

Hobbs graduated this spring with a degree in chemical engineering, and Eaves will be a senior this fall in materials science engineering. This summer, Hobbs is working on the Miss Possible project from [co][lab] in downtown Urbana. She plans to go to work for Eli Lilly & Co. in August. Eaves is serving an internship with SpaceX, the rocket and spacecraft company, this summer.

To learn more:
www.bemisspossible.com

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Chemical Engineering alums earn honors from American Chemical Society

Two alums from the Department of Chemical and Biomolecular Engineering at the University of Illinois have received national awards from the American Chemical Society (ACS). The awards were presented at the 247th ACS meeting in Dallas.

William F. Banholzer

Joan F. Brennecke

William F. Banholzer, '81 M.S., '83 Ph.D. (Masel), who earned his master's and doctorate degrees in chemical engineering from the University of Illinois, was the recipient of the Earle B. Barnes Award for Leadership in Chemical Research Management, sponsored by the Dow Chemical Company Foundation.

Banholzer, retired executive vice president and chief technology officer for The Dow Chemical Company, was responsible for Dow's research and development activities around the world. In 2002, Banholzer was elected to the U.S. National Academy of Engineering, one of the highest distinctions that can be accorded an engineer. In 2013, he joined the University of Wisconsin-Madison as a research professor.

Joan F. Brennecke, '87 M.S., '89 Ph.D. (Eckert), Keating-Crawford Professor of Chemical Engineering at University of Notre Dame's Department of Chemical and Biomolecular Engineering, was awarded the E. V. Murphree Award in Industrial and Engineering Chemistry, sponsored by ExxonMobil Research & Engineering.

She earned her master's and doctorate degrees from the University of Illinois. She was inducted into the National Academy of Engineering in 2012. Brennecke's primary research lie in the measurement and modeling of thermodynamics, thermophysical properties, phase behavior, and separations.

Class Notes

Brian C. Kwok, B.S. '00, was elected a partner of Mavrakakis Law Group LLP in Palo Alto, California, and focuses his practice on patent litigation and licensing. He counsels clients on resolving patent disputes before litigation ensues and represents clients in patent infringement litigation proceedings in federal district courts and before the International Trade Commission. Brian completed his J.D. at Wisconsin Law School in 2006.

Cameron G. Butler, B.S. '13, is a process engineer at BP in Naperville, Illinois.

Christopher Hood, B.S. '93, was promoted to Executive Quality Operations at GE Healthcare in Waukesha, Wisconsin in September 2013.

Submit your class note. Use the attached card in this newsletter or go.illinois.edu/chbe_alumni_form

Brian C. Kwok

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Giving to Chemical and Biomolecular Engineering

Matthew Campion has become the newest member of LAS Advancement in his role as Assistant Director of Development for the School of Chemical Sciences. Working with Lauren Dodge, Campion will visit and engage with Chemical and Biomolecular Engineering alumni from across the Midwest and parts of the East Coast. He looks forward to visiting and talking with alumni and furthering their engagement and relationships with the department.

Campion earned his B.A. in Political Science from the University of Illinois at Urbana-Champaign where he served two years as President of the LAS Leaders, a student alumni group for the College of LAS. While on campus, he also served on the executive board for his fraternity, Sigma Phi Epsilon, and coached a Champaign Park District basketball team for three years.

"I learned about advancement and development roles while a student at Illinois, and it helped shape my career path in higher education," Campion said. "The Chemical and Biomolecular Engineering Department has so many generous alumni, and it will be an honor to work with such notable individuals. I am excited to serve the department and will do my best to further its mission and vision by working with all of our wonderful alumni."

~ Matthew Campion

Matthew Campion

Lauren Dodge

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In Memoriam

Bion Dwight Barger died February 16, 11 days after his 90th birthday. He was born on February 5, 1924. In September 1941 he enrolled in chemical engineering at the University of Illinois. He left school, served in the military and returned to the University of Illinois graduating in 1949. He earned a master's degree in chemical engineering at the University of Washington. Barger worked at several chemical companies before joining Standard Oil where he worked for 24 years, retiring in 1981 at age 58.

Melford Ray Beamon, age 80, passed away December 23, 2013. He received his B.S. degree in Chemical Engineering in 1956 from the University of Illinois. He served in the U.S. Corp of Engineers and in 1962 he joined Eli Lilly and Co. in Indianapolis, Indiana, retiring in 1991. Assignments included project engineering, production assignment, and the role of Manager of Engineering and Maintenance at the Clinton, Indiana plant of Eli Lilly and Company.

George Daley Bevis, B.S. '49, died May 19, 2014. He was 89, a native of Newton, Illinois and a resident of Baton Rouge, Louisiana. Bevis was a retired chemical engineer with Borden Chemical Company, with 30 years of service. He was a graduate of the University of Illinois and served his country during World War II as a U.S. Navy veteran in the Pacific Theatre. He was an active member of the United Methodist Church and an avid golfer. He is survived by his wife of 65 years, two daughters, a son, two grandchildren, and two great-grandchildren.

Vernon J. Bogner, 79, of Winchester, Virginia, passed away January 25, 2014. He was born in Henry, Illinois on April 26, 1934. He received his B.A. in chemical engineering from the University of Illinois and pursued his MBA from James Madison University. Bogner served in the U.S. Army during the Korean conflict. He worked for BF Goodrich Chemical, followed by 32 years as a chemical engineer at 3M Company. He was a member of the American Institute of Chemical Engineers, The American Institute of Plant Engineers, and the 3M Retiree Groups.

Dr. David R. Carter, a chemical engineer and expert in the application of polymers to the science and engineering of automotive materials, died December 11, 2013. Carter earned a bachelor's degree from Stanford University in 1961, a master's degree in 1962 from the University of Illinois, both in chemical engineering, and a doctorate in Macromolecular Science and Engineering from Case Western Reserve University in 1967. Carter began his career with the Dow Chemical Co. and then moved to the Firestone Research Laboratories. He later joined the Raybestos Division of Echlin Industries, doing research on brake materials and shock absorbers. In March 1996, along with colleagues he was awarded a joint U.S. patent on a new friction material that resulted in reduced disc brake noise.

Stanley Douglas (Stan) Heden passed away November 16, 2013 in San Diego, California. After attending the University of Minnesota, he served in the U.S. Navy ROTC and was commissioned as an Ensign in the U.S. Navy. He graduated from the University of Illinois in 1948, earning a B.S. in Chemical Engineering. He began his engineering career in Chicago, later relocating to Tucson, Arizona, Sydney, Australia, Richmond, Virginia, and Salt Lake City. He received his Professional Engineering (P.E.) license while working as an Environmental Engineer.

David James Lamoree passed away on December 9, 2013 at the age of 89. He graduated from the University of Illinois with a B.S. in chemical engineering in 1949. His college years were interrupted by World War II when he served in the Army Infantry. He fought in the Battle of the Bulge and was awarded the Bronze Star. He began his life's career as a chemical engineer with Sinclair Oil of Chicago and later moved to Vallejo in 1958 to work for more than 30 years with Chevron Research in Richmond.

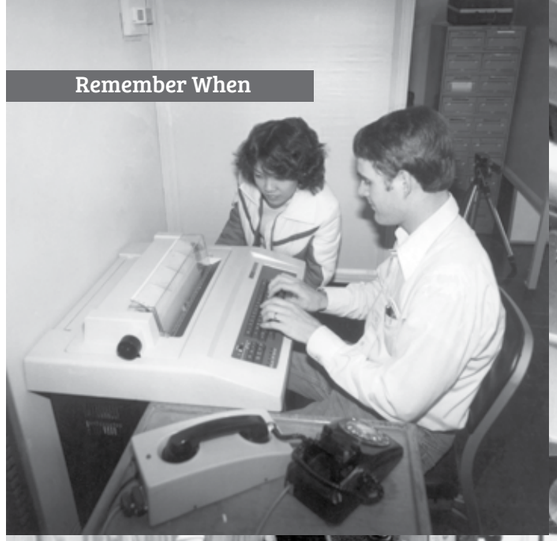
Myron Pfeifer was born in Illiopolis, Illinois September 15, 1921 and passed away January 19, 2014. Pfeifer graduated from the University of Illinois in 1943 with a degree in chemical engineering. While at the university, he was awarded three letters in varsity football. Pfeifer was employed by the BF Goodrich Chemical Company until 1959 when he co-founded a plastic extrusion plant. He then founded P & S Engineered Plastics, a plastic injection molding company specializing in plastic parts for the automobile industry. Pfeifer retired in 1999.

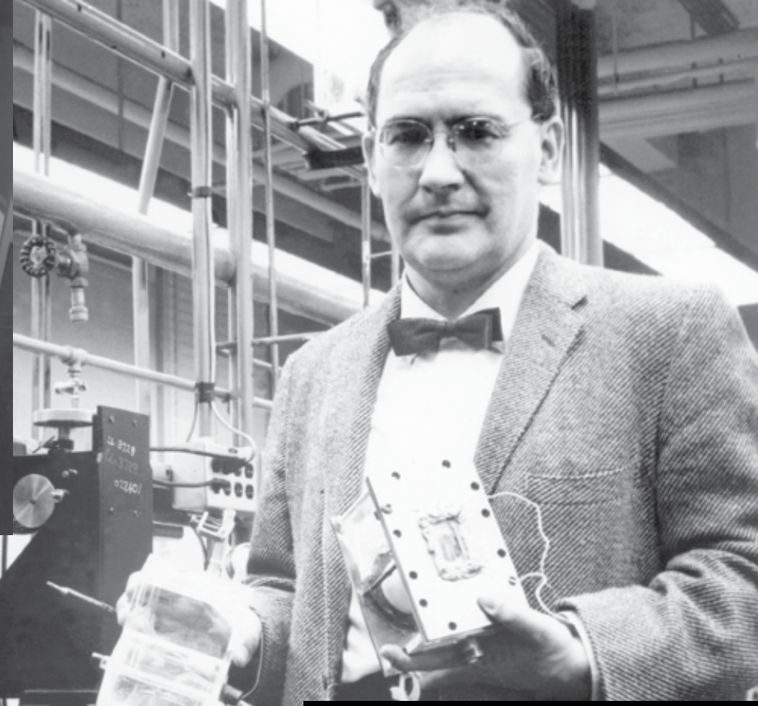
Raymond Peter Seven, age 92, of Grand Rapids, Michigan, passed away April 6, 2014. He was born on December 5, 1921. Seven received his undergraduate degree from Calvin College and the University of Michigan and his Ph.D. in Chemical Engineering from the University of Illinois. He was a veteran who served in the U.S. Army in the 1940s as a research scientist for the Manhattan Project. He worked at Edwal Labs as a research scientist, as an executive for the Morton Chemical Company, and later as president of NorAm Chemical Company. He was a natural teacher, saw most of life as a teachable moment, and instilled his love of God, travel, and learning in his children and grandchildren.

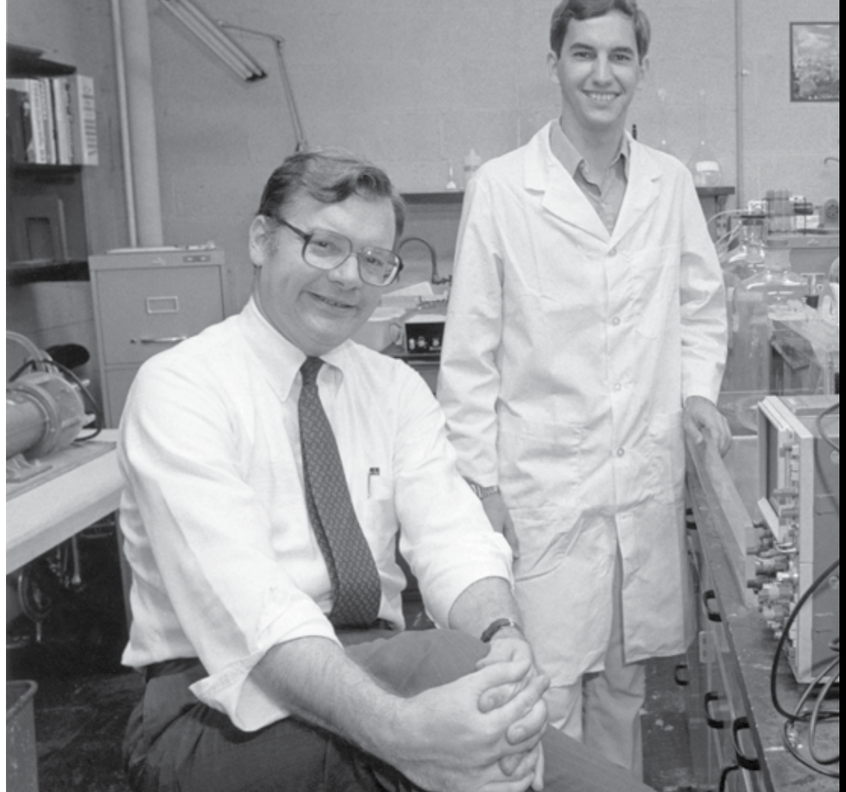
William Murray Schott, 68, passed away January 4, 2014. He received a B.S. degree in chemical engineering in 1968 from the University of Illinois. He served in the U.S. Army. He later received an MBA from Washington University and worked for many years in the chemical industry. He eventually retired from this work and earned a master's degree in Romance Languages and enjoyed working as an adjunct professor of Spanish.

Patrick F. Tomlan, 70, of Wilmington, passed away on March 16, 2014. Tomlan was born in Duluth, Minnesota in 1943. He graduated from the University of Minnesota in 1965 with a degree in engineering and from the University of Illinois in 1969 with a Ph.D. in chemical engineering. He and his wife, Judy, moved to Wilmington in 1969 to work at DuPont until his retirement in 2006. Tomlan was active in his church as a deacon and in other administrative positions.

Remember When







Chemical Engineering at Illinois

Bottom: Emeritus Professor **Richard Alkire** (at left), who also is the Charles and Dorothy Prizer Chair, in his lab with graduate student **Steve Perusich**, MS '82 PhD '85. Perusich's wife, **Elizabeth Renee (Roberts) Perusich**, '83 MS, '85 PhD, also is an alum of the department. Photo circa 1983.

Top left: Graduate students **Iris W. Shiu**, MS '80, and **Courtland M. Hilton**, PhD '80 (Stadtherr) work on complex chemical processing systems using computer simulations. Photo circa 1980

Above: **James W. Westwater** (1919-2006), Emeritus Professor of Chemical Engineering, served as the head of the Department of Chemical Engineering a Illinois from 1962 to 1980. He retired in 1988. He was elected into the national Academy of Engineering in 1974 "for contributions to boiling heat transfer by high-speed photography at great magnification."

Share your memories with us! Email your memories from these photos or send us your photos to be featured in upcoming issues of Mass Transfer. Send them online: go.illinois.edu/chbe_alumni_form or mail them to us.

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Save the Date

Homecoming 2014

October 24 and 25

Visit the department's alumni tent on Saturday, October 25 for free food, football tickets and more! Like the Chemical and Biomolecular Engineering Facebook page for details!

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Graduates celebrate their achievements during the department's convocation ceremony.